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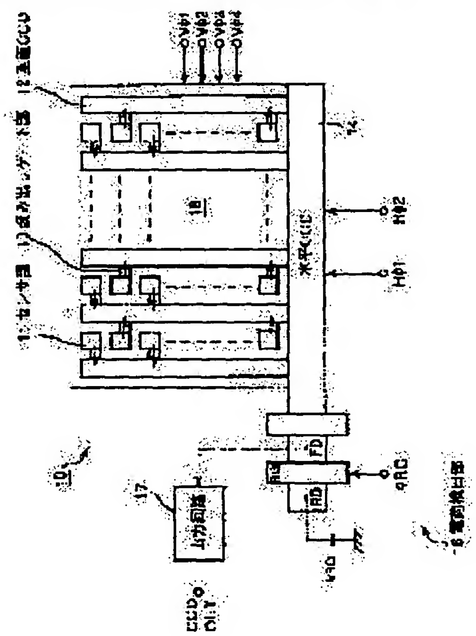
(54) SOLID-STATE IMAGE PICK UP DEVICE, METHOD OF DRIVING THE SAME AND CAMERA SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To enable the desired vertical compression for common use in moving image sending/static image sending in the well-balanced horizontal and vertical resolution.
SOLUTION: Each signal charge of a sensor group located in every other row among a plurality of sensors 11 arranged in the shape of matrix is read, for example, with vertical CCD 12 located in the left side of figure. Each signal charge of the other sensor group located in every other row is read, for example, with vertical CCD 12 located in the right side of figure, and the signal charges of sloping two pixels read from each sensor 12 are added in each vertical CCD 12 of a plurality of vertical CCDs. Moreover, the signal charges of a plurality of lines are added in the horizontal CCD 14 and are then outputted.



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CLAIMS

[Claim(s)]
[Claim 1] The solid state image pickup device characterized by providing the following. Two or more sensor sections allotted in the shape of a matrix. Two or more perpendicular transfer sections allotted for every train to two or more aforementioned sensor sections. The read-out means which reads each signal charge of sensor **** located every party among two or more aforementioned sensor sections to the perpendicular transfer section located in the one side of two or more aforementioned perpendicular transfer sections, and reads each signal charge of sensor **** located every parties of other to the perpendicular transfer section located in the other side of two or more aforementioned perpendicular transfer sections.
[Claim 2] The solid state image pickup device according to claim 1 characterized by having the addition driving means adding the signal charge of 2 pixels of slant read from two or more aforementioned sensor sections in each of two or more aforementioned perpendicular transfer sections, and the level transfer section which carries out the level transfer of this in response to the signal charge added 2 pixels of slant per line in each of two or more aforementioned perpendicular transfer sections.
[Claim 3] The solid state image pickup device according to claim 2 characterized by adding the signal charge for two or more lines by the aforementioned level transfer circles.
[Claim 4] The aforementioned addition driving means are solid state image pickup devices according to claim 2 characterized by changing the combination of slanting addition in the 1st field and the 2nd field.
[Claim 5] The solid state image pickup device according to claim 3 characterized by changing the combination of addition in the 1st field and the 2nd field in the addition for two or more lines in the aforementioned level transfer circles.
[Claim 6] The aforementioned addition driving means are solid state image pickup devices according to claim 2 characterized by changing the combination of slanting addition by the line.
[Claim 7] The solid state image pickup device according to claim 2 characterized by having the light filter in which the same color has color coding repeated every 2 pixels in a line writing direction.
[Claim 8] The aforementioned light filter is a solid state image pickup device according to claim 7 characterized by having color coding from which the same color is repeated every 4 pixels in the direction of a train, and a color-difference signal serves as point sequential by 2 pixel addition of slanting in each of two or more aforementioned perpendicular transfer sections.
[Claim 9] Each signal charge of sensor **** located every party among two or more sensor sections allotted in the shape of a matrix It reads to the perpendicular transfer section located in the one side of two or more perpendicular transfer sections allotted for every train to two or more aforementioned sensor sections. Each signal charge of sensor **** located others and every party among two or more aforementioned sensor sections is read to the perpendicular transfer section located in the other side of two or more aforementioned perpendicular transfer sections. The drive method of the solid state image pickup device characterized by adding the signal charge of 2 pixels of slant read from two or more aforementioned sensor sections in each of two or more aforementioned perpendicular transfer sections.
[Claim 10] The drive method of the solid state image pickup device according to claim 9 characterized by transporting the signal charge added 2 pixels of slant in each of two or more aforementioned perpendicular transfer sections to the level transfer section per line, and adding the signal charge for two or more lines by these level transfer circles.
[Claim 11] The camera system characterized by providing the following. While reading each signal charge of sensor **** located every party among two or more sensor sections allotted in the shape of a matrix to the perpendicular transfer section located in the one side of two or more perpendicular transfer sections allotted for every train to two or more aforementioned sensor sections The signal charge of 2 pixels of slant which read each signal charge of sensor **** located every parties of other to the perpendicular transfer section located in the other side of two or more

aforementioned perpendicular transfer sections, and was read from two or more aforementioned sensor sections in each of two or more aforementioned perpendicular transfer sections is added, and it is the solid state image pickup device in which an output is possible. It is the image pck-up mode setting means which can be set up alternatively about still picture mode and animation mode. Driving means which drive the aforementioned solid state image pickup device according to the image pck-up mode set up by the aforementioned image pck-up mode setting means.

[Claim 12] It is the camera system according to claim 11 by which the aforementioned solid state image pickup device has the level transfer section which carries out the level transfer of this in response to a signal charge in the line unit added 2 pixels of slant in each of two or more aforementioned perpendicular transfer sections, and the aforementioned driving means are characterized by adding the signal charge for two or more lines by the aforementioned level transfer circles when animation mode is set up by the aforementioned image pck-up mode setting means.

[Claim 13] The aforementioned driving means are camera systems according to claim 11 characterized by changing the combination of slanting addition in the 1st field and the 2nd field, and performing interlace operation when animation mode is set up by the aforementioned image pck-up mode setting means.

[Claim 14] The aforementioned driving means are camera systems according to claim 11 characterized by changing the combination of addition by the aforementioned level transfer circles in the 1st field and the 2nd field, and performing interlace operation when animation mode is set up by the aforementioned image pck-up mode setting means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the camera system using the solid state image pickup device of the color method which can be used especially also [animation / a still picture/], its drive method, and the solid state image pickup device concerned as an image pickup device about a solid state image pickup device, its drive method, and a camera system.
[0002]
[Description of the Prior Art] In recent years, development of the solid state image pickup device in which a still picture / animation combination is possible is furthered against the background of the expectation for still functional loading to a video camera etc. Generally, a still picture can consider a tetragonal lattice and the animation is considered considering 13.5MHz as the base. Therefore, in order to make both serve a double purpose, interpolation/compression is needed with one of methods. Here, since an animation is ****(ed) with broadcasting formats, such as NTSC/PAL, to a still picture being a high pixel non format, it is considered to be the most efficient by the down conversion from the solid state image pickup device of the many pixels for still pictures to make television signals, such as NTSC/PAL.
[0003] The method which performs the so-called infanticide read-out which does not read the signal charge of some lines from the sensor section to the perpendicular transfer section, but reads only the signal charge of other lines from the sensor section to the perpendicular transfer section as technique for down conversion (raise in frame rate), the method which starts the central field of an effective pixel field like [in hand deflection amendment] are learned.
[0004] In the digital still camera using the solid state image pickup device which has a primary color filter as an image pickup device etc., it is not reading the signal charge of some lines from the sensor section to the perpendicular transfer section, the former method cut down the information on vertical, has realized high frame rate-ization, and when mainly outputting the image information of many pixels to a liquid crystal TV monitor, it is used. However, since a signal was thinned out, a sampling frequency would be lowered and a spatial clinch increased by this technique, it was unsuitable for the purpose which a beautiful picture is not acquired but carries out record storage as an animation.
[0005] On the other hand, while change of the field angle between a still picture/animation will become large if a broadcasting format is started at the time of many pixels when the latter method is used, a result which throws away many pixel information is brought and efficiency is bad. Since it is such, the technique of performing perpendicular compression processing of a still picture/animation by mixture (perpendicular addition) in the transfer process of a signal charge is conventionally taken as the method of down conversion.
[0006] In order to perform perpendicular compression processing in the transfer process of this signal charge, color coding of a light filter serves as the biggest technical problem. That is, to it being safe to carry out perpendicular addition of the case of primary colors R (red), G (green), and B (blue) as a vertical stripe, the complementary color becomes disadvantageous in respect of horizontal color resolution, when it is made into those of C (cyanogen), Y (yellow), G (green), and M (Magenta) with 4 colors, and a vertical stripe. Then, the technique of the shift addition (level shift addition is called hereafter) by the level transfer section is taken, and suppose that it is always fixed about level drive frequency.
[0007] however, in complementary color check color coding arranged as C, Y, G, and M showed drawing 24 Since it corresponds to interlace operation, the signal charge for 2 pixels is mixed in a perpendicular direction. (Perpendicular mixture of 2 pixels is called hereafter) The color-difference signals Cr (G+C, M+Y) and Cb (M+C, G+Y) obtained by carrying out were perpendicular, and since they served as the line sequential obtained by turns, they were impossible for perpendicular mixture of having held color-difference signals Cr and Cb. In addition, in drawing 24 , left-hand side shows the odd number (ODD) field, and right-hand side shows the even number (EVEN) field, respectively.
[0008] on the other hand, in order to enable perpendicular mixture and to realize level shift addition, ****

complementary color color coding shown in drawing 25 is proposed (reference; -- 1997 year Institute of Image Information and Television Engineers annual meeting (ITE'97:1997 ITE Annual Convention) "examination of the veneer color image pck-up which has Hi-Vision / NTSC output" pp37 - pp38 reference) According to this complementary color color coding, it will be obtained in the shape of [of color-difference signals Cr (G+C M+Y) and Cb (M+C, G+Y)5] an eye so that clearly from drawing 25 .

[0009] Thus, in the conventional complementary color color coding used as arrangement of the shape of an eye of color-difference signals Cr and Cb5, as shown in drawing 26 , after carrying out the 2-bit (2 pixels) shift of the signal charge for one line by which the line shift was carried out previously at the level transfer section in a level blanking period, the signals of the same color component can carry out perpendicular mixture by carrying out the line shift of the following signal charge for one line. That is, perpendicular mixture can be realized, with the color-difference signals Cr and Cb held.

[0010]

[Problem(s) to be Solved by the Invention] The arrangement Cr and Cb of the shape of an eye of color-difference signals Cr and Cb5, i.e., color-difference signals, however, in the case of a horizontal direction and complementary color color coding perpendicular and obtained by turns As mentioned above, in order for addition of the signals of the perpendicular mixture accompanied by level 2 bit shifts, i.e., the same color component left by 2 pixels, to realize perpendicular compression processing, level 2 repeat coding usual in horizontal color resolution -- receiving -- level 4 repeats -- being of the same grade (namely, 1/2) -- the technical problem that it falls occurs

[0011] Arbitrary perpendicular compression is possible for the place which this invention is made in view of the above-mentioned technical problem, and is made into the purpose, and it is to provide with a camera system the solid state image pickup device which can be used also [image pck-up / the animation image pck-up / still picture image pck-up / which was able to balance level and the vertical definition], and its drive method row.

[0012]

[Means for Solving the Problem] Two or more sensor sections to which the solid state image pickup device by this invention was allotted in the shape of a matrix, Two or more perpendicular transfer sections allotted for every train to the sensor section of these plurality, Each signal charge of sensor **** located every party among two or more sensor sections is read to the perpendicular transfer section located in the one side of two or more perpendicular transfer sections. It has the read-out means which reads each signal charge of sensor **** located every parties of other to the perpendicular transfer section located in the other side of two or more perpendicular transfer sections. Furthermore, it has the addition driving means adding the signal charge of 2 pixels of slant read from two or more sensor sections in each of two or more perpendicular transfer sections.

[0013] In the solid state image pickup device and its drive method of the above-mentioned composition, each signal charge of the pixel group located every party among two or more pixels (sensor section) is read to the perpendicular transfer section located in left-hand side, and each signal charge of the pixel group located every parties of other is read to the perpendicular transfer section located in right-hand side. Then, the signal charge of two pixels located aslant mutually is read to two transfer stages in which the same perpendicular transfer section adjoins each other on a pixel array. And each signal charge of two adjacent transfer stages is added by performing the same drive as field read-out of common knowledge. That is, addition read-out of the signal charge of 2 pixels of slant is performed.

[0014] The inside of two or more pixels on which the camera system by this invention was arranged in the shape of a matrix, Each signal charge of the pixel group located every party is read to the perpendicular transfer section located in left-hand side. The signal charge of 2 pixels of slant which read to the perpendicular transfer section located in right-hand side, and was read from each pixel in each of two or more perpendicular transfer sections is added for each signal charge of the pixel group located every parties of other, and the solid state image pickup device in which an output is possible is used as an image pickup device. Moreover, a setup of still picture mode and animation mode is alternatively enabled to this solid state image pickup device. And while driving a solid state image pickup device according to the image pck-up mode, at the time of a setup in animation image pck-up mode, it is made to add the signal charge 2 pixels across perpendicular transfer circles.

[0015]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained in detail with reference to a drawing. In addition, although the case where it applies to a CCD type image pck-up element (a CCD image sensor is called hereafter) is mentioned as an example and the following explanation explains it, it is not limited to this and can apply to a solid state image pickup device at large.

[0016] Drawing 1 is the outline block diagram showing the CCD image sensor concerning 1 operation form of this invention, for example, takes and shows the case where it applies to the veneer color CCD image sensor of an information-separator(interlace scan)-IT (interchange line transfer) method to the example.

[0017] In drawing 1 , CCD image sensor 10 concerning this operation form Between two or more perpendicular CCD (perpendicular transfer section)12, and the sensor section 11 and perpendicular CCD12 which were allotted for every vertical file of two or more sensor sections (pixel) 11 allotted in the shape of a matrix, and these sensor section 11 It has the composition of having the charge detecting element 16 and output circuit 17 which were allotted to the edge by the side of the destination of level CCD (level transfer section)14 and level CCD14 which were allotted to one read-out gate section [intervening] 13 and edge side of perpendicular CCD12.
[0018] Moreover, although not shown in drawing 1 , on the image pck-up area (pixel area) 18 of CCD image sensor 10, the light filter 19 of complementary color check color coding is allotted. As shown in drawing 2 , even lines this light filter 19 M/C/G/C, The color coding 19-1 of G/Y/M/Y (A) or even lines M/C/G/Y, [odd lines] odd lines sets to the color coding 19-2 of G/Y/M/C (B), the same color sets horizontally (the direction of a train), and it is repeated every 4 pixels, and is repeated every 2 pixels in a perpendicular direction (the direction of a train) -- it is color coding of perpendicular 2 repeat [level 4]
[0019] In CCD image sensor 10 of this composition, the sensor section 11 consists of a photodiode of a PN junction, and photo electric translation of the incident light is carried out to the signal charge of the amount of charges according to the quantity of light, and it accumulates it. Two or more perpendicular CCD12 is allotted for every train to two or more sensor sections 11 allotted in the shape of a matrix.
[0020] The read-out gate section 13 by impressing the read-out pulse XSG mentioned later It is one side (in this example) about the signal charge of the sensor section 11 of sensor **** located every party, for example, an odd number (ODD) line. It reads to perpendicular CCD12 located in the left-hand side of drawing, and has become sensor **** located every parties of other, for example, the composition which reads the signal charge of the sensor section 11 of an even number (EVEN) line to perpendicular CCD12 located in the other side (this example right-hand side of drawing). About the concrete composition of this read-out gate section 13, it mentions later.
[0021] The transfer drive of perpendicular CCD12 is carried out by the perpendicular transfer clock Vphi1 to Vphi4 of four phases. Among the perpendicular transfer clocks Vphi1 to Vphi4 of four phases, as shown in the wave form chart of drawing 3 , the perpendicular transfer clock Vphi1 and Vphi3 are set up so that three values of a low ("L" level), middle level ("M" level), and a high level ("H" level) may be taken, and the pulse of eye three values ("H" level) generate in a perpendicular blanking period reads them, and they become Pulse XSG.
[0022] Within perpendicular CCD12, while addition of a signal charge is performed by the timing relationship of the perpendicular transfer clock Vphi1 to Vphi4 of four phases between two adjacent packets like the case of a well-known field read-out drive, the combination of the packet to add changes in the 1st field and the 2nd field. Here, a packet shall mean the unit (1 transfer stage) treating the signal charge for 1 pixel.
[0023] Namely, as shown in drawing 3 (A), after it reads to the perpendicular transfer clock Vphi1 and Vphi3 and Pulse XSG stands in the 1st field, Addition of a signal charge is performed between each [equivalent to the 1st line of the pixel array / the perpendicular transfer clock Vphi1 to Vphi3 / of "M" level and the perpendicular transfer clock Vphi4 by "L" level and the bird clapper, the 2nd line, the 3rd line, the 4th line, and ....] packet.
[0024] As shown in drawing 3 (B), after it reads to the perpendicular transfer clock Vphi1 and Vphi3 and Pulse XSG stands in the 2nd field, Addition of a signal charge is performed between each [equivalent to the 2nd line of the pixel array / the perpendicular transfer clock Vphi1, Vphi3, and Vphi4 / of "M" level and the perpendicular transfer clock Vphi2 by "L" level and the bird clapper, the 3rd line, the 4th line, the 5th line, and ....] packet.
[0025] And when a transfer drive is carried out by the perpendicular transfer clock Vphi1 to Vphi4, in a part of level blanking period, the perpendicular transfer (line shift) of the signal charge added among adjacent 2 packets is carried out, and perpendicular CCD12 transports it to level CCD14, as shown in the timing chart of drawing 4 .
[0026] When a transfer drive is carried out by the level transfer clock Hphi1 of two phases, and Hphi2, level CCD14 carries out the level transfer of the signal charge by which the line shift was carried out from perpendicular CCD12 one by one in the horizontal scanning period after a level blanking period, and supplies it to the charge detecting element 16. Operation of this level CCD14 is the transfer operation in the normal mode.
[0027] The charge detecting element 16 is constituted by for example, floating diffusion amplifier. That is, it consists of the reset gate RG allotted between the floating diffusion FD into which a signal charge is poured from level CCD14, and the floating diffusion FD and the reset drain RD which discharge a charge, the signal charge supplied one by one from level CCD14 is detected, and this is changed into a signal level. [the reset drain RD, and] The predetermined reset drain voltage VRD is impressed to the reset drain RD.
[0028] Drawing 5 is the flat-surface pattern view showing an example of the concrete composition of the sensor section 11, perpendicular CCD12, and the read-out gate section 13. In drawing 5 , perpendicular CCD12 has the composition of having the transfer electrode 22-1 to 22-4 corresponding to the perpendicular transfer clock Vphi1 to Vphi4 of four phases which are perpendicularly allotted in order above two or more transfer channels 21 which extend

perpendicularly in parallel, and these transfers channel 21, and extend in parallel horizontally. The transfer electrode 22-1 to 22-4 is formed considering two lines (perpendicular of 2 pixels) as one unit.
[0029] The transfer electrode 22-2 to which the perpendicular transfer clock Vphi2 of eye two phases and eye four phases and Vphi4 are impressed in these transfer electrodes 22-1 to 22-4, and 22-4 are contest polysilicon of the 1st layer (among drawing). an alternate long and short dash line -- being shown -- it is formed and the perpendicular transfer clock Vphi1 of eye one phase and a three-phase-circuit eye, the transfer electrode 22-1 to which Vphi3 is impressed, and 22-3 are formed by contest polysilicon of a two-layer eye (a two-dot chain line shows among drawing) And the transfer electrode 22-2 which consists of contest polysilicon of the 1st layer, 22-4, and the transfer electrode 22-1 which consists of contest polysilicon of a two-layer eye and 22-3 overlap mutually on the transfer channel 21.
[0030] Here, in the circumference of the sensor section 11, as hatching shows to drawing 5 , about every party's (this example odd lines) each sensor section 11o, the configuration except the channel stop section 23 for isolation is carried out [e / each sensor section 11/ of the left-hand side of drawing, and every parties (this example even lines) of other] in the right-hand side of drawing. On the other hand, the transfer electrode 22-1 to 22-4 is broadly formed to the opening edge of not only the transfer channel 21 top but the sensor section 11, was read in the portion in which the channel stop section 23 is not formed, and serves as the gate electrode of the gate section 13.
[0031] In the above-mentioned pixel structure, read-out of the signal charge from each sensor section 11 is performed by the read-out pulse's XSG reading through the transfer electrode 22-1 and 22-3, and being impressed by the gate section 13. It is that read to the perpendicular transfer clock Vphi1 of eye one phase, and Pulse XSG specifically stands, and the signal charge of sensor section 11o of odd lines is read to perpendicular CCD12 located in the left-hand side of drawing, as a leftward arrow shows. Moreover, as a rightward arrow shows, the signal charge of sensor section 11e of even lines is read to perpendicular CCD12 located in the right-hand side of drawing, because read to the perpendicular transfer clock Vphi3 of a three-phase-circuit eye and Pulse XSG stands.
[0032] In CCD image sensor 10 which has the light filter 19 of color coding of perpendicular 2 repeat [level 4] as mentioned above It is one side (in this example) in sensor **** located every party, for example, the signal charge of sensor section 11o of odd lines. It is the other side (in this example) in sensor **** which reads to perpendicular CCD12 located in the left-hand side of drawing, and is located every parties of other, for example, the signal charge of sensor section 11e of even lines. By having made it read to perpendicular CCD12 located in the right-hand side of drawing, addition of the signal charge of two adjacent packets is performed within perpendicular CCD12. Addition of the signal charge for 2 pixels aslant located in a pixel array by this addition is performed.
[0033] That is, in CCD image sensor 10 in which color coding shown in drawing 2 (A), i.e., odd lines, has M/C/G/C, and even lines has the light filter 19-1 of complementary color color coding of G/Y/M/Y, the color difference (chroma) signals Cr and Cb are outputted by point sequential by performing 2 pixel addition (mixture) of slanting. In addition, in this example, although even lines explained the case where it was G/Y/M/Y, M/C/G/C and odd lines [color coding of a light filter 19-1] Not the thing restricted to this but color coding shown in drawing 2 (B), G/Y/M/C and even lines Namely, M/C/M/Y, [even lines] [M/C/G/Y and odd lines] Odd lines should just be color coding from which color-difference signals Cr and Cb serve as point sequential at the time of the 2 pixel addition of slanting, such as G/Y/G/C or color coding which odd lines and even lines replaced, respectively.
[0034] Here, general complementary color color coding shown in drawing 6 is taken and explained to an example about the relation between complementary color color coding and color-difference signals Cr and Cb.
[0035] Usually, by the CCD image sensor, since field read-out is performed, mixture of a signal charge is performed in combination with a perpendicular [of a1 and a2] of 2 pixels in the 1st field. Therefore, considering a1 line, the turn of the signal charge transmitted by level CCD becomes (G+Cy), (Mg+Ye), (G+Cy), (Mg+Ye), and .... In addition, in the 2nd field, it becomes combination with a perpendicular [of b] of 2 pixels.
[0036] In order to change into an electrical signal the signal charge outputted in this turn, to process this by the latter chrominance-signal processor and to constitute a luminance signal Y and color-difference signals Cr and Cb, a Y signal adds next doors and color-difference signals Cr and Cb are reduced. That is, a Y signal is Y-signal =|(G+Cy)+(Mg+Ye) |x1/2=1 / 2 (2B+3G+2R).
A ****** signal is used. A color-difference signal Cr is Cr= (Mg+Ye). - (G+Cy)
A ****** signal is used.
[0037] Next, considering a2 line, from level CCD, when this constitutes a Y signal from a thing of (Mg+Cy), (G+Ye), (Mg+Cy), (G+Ye), and .... outputted in turn, it is Y-signal =|(G+Ye)+(Mg+Cy) |x1/2=1 / 2 (2B+3G+2R).
It balances with the same composition as a next door and a1 line. Similarly, a color-difference signal Cb is Cb= (G+Ye). - (Mg+Cy)
It comes out and approximates. The same is said of the 2nd field.
[0038] On the other hand by CCD image sensor 10 concerning this operation form Level 4 by performing field read-

out and performing 2 pixel addition of slanting within perpendicular CCD12 to complementary color color coding (seeing drawing 2) of perpendicular 2 repeat, repeatedly From level CCD14, in each lines a1, a2, and a3, a signal charge is outputted in order of ?+M, G+C, Y+G, M+C, Y+M, G+C, Y+G, M+C, Y+M, and G+? so that clearly from explanatory drawing of drawing 7 of operation.
[0039] Here, it expresses the color-difference signal Cb that having attached the underline does not attach an underline for a color-difference signal Cr, respectively. Here, M and Cy shall be written as C, Ye shall be written as Y, and the following explanation also makes Mg the same. In addition, drawing 7 is explanation of operation in the case of the 1st field. In this 1st field, 2-pixel addition is performed between diagonally right (diagonal below) pixels about one certain pixel.
[0040] On the other hand, in the 2nd field, since the combination of two packets to add changes as point ** was carried out, 2-pixel addition is performed between diagonally left (diagonal below) pixels about one certain pixel. Thereby, in each lines b1 and b2, a signal charge is outputted in order of ?+M, G+C, Y+G, M+C, Y+M, G+C, Y+G, M+C, Y+M, and G+? so that clearly from explanatory drawing of drawing 8 of operation.
[0041] Thus, color-difference signals Cr and Cb will be outputted by point sequential by performing 2 pixel addition of slanting to complementary color color coding of perpendicular 2 repeat [level 4]. And interlace operation is realizable by changing the combination of 2 pixels which carries out slanting addition in the 1st field and the 2nd field.
[0042] Moreover, a luminance signal is obtained by addition of each pixel signal of Y/M/G/C so that clearly from having carried out point **. Therefore, if the signal charge by the 2 pixel addition of slanting outputted from level CCD14 is made into 1 bit, a luminance signal will be obtained when 2 bits carries out addition processing at a time in a latter digital disposal circuit. Although it becomes addition for 4 pixels at this time, since 2 pixel addition of slanting is performed within perpendicular CCD12, if horizontal, substantially, it becomes an equivalent for 3-pixel addition the perpendicular of 2 pixels.
[0043] Consequently, if perpendicular, 2-pixel addition and since it becomes 3-pixel addition if horizontal, it is horizontal and the balance of a vertical definition and horizontal resolution will become good compared with the case where 4 pixels is added. Moreover, since only the same color will exist in each of perpendicular CCD12, it becomes it is perpendicular and possible to carry out addition compression further. Frame rate can be raised by performing further addition compression in this perpendicular direction. In addition, in level CCD14, addition compression in a perpendicular direction is in the state which stopped the level transfer operation, and can be realized by performing perpendicular transfer (line shift) operation two lines or more than it.
[0044] CCD image sensor 10 in which the down conversion by the addition compression based on the 2 pixel addition of slanting explained above is possible is used as an image pickup device of the still picture / animation combination which can respond to the both sides of a still picture image pck-up and an animation image pck-up. Specifically, CCD image sensor 10 is used as the image pck-up element of still picture many pixels, and the television signal corresponding to television systems, such as NTSC/PAL/HDTV, is made by the down conversion by the addition compression from the CCD image sensor of these still picture many pixels.
[0045] in addition, in using as an image pickup device of a still picture Since CCD image sensor 10 concerning this operation form is the structure on condition of the 2 pixel addition of slanting, as an example In the 1st field, read only to the perpendicular transfer clock Vphi3, read only to the perpendicular transfer clock Vphi1 in the 2nd field, and make it Pulse XSG stand, namely, by performing the same drive as frame read-out of common knowledge The information on all pixels can be acquired independently in the 2 fields, and, thereby, a high-definition still picture can be obtained.
[0046] The case of the pixel composition shown in drawing 9 is considered as an example which makes the television signal corresponding to each television system here. The pixel composition of 1440 is shown [the number of level pixels in the effective pixel field 31] for 1920 and the number of perpendicular pixels (the number of lines) in drawing 9 . In addition, some effective pixel other than the optical black (optical black) field for acquiring black information is allotted in fact to the four directions of the effective pixel field 31. Moreover, as for the level drive frequency at the time of interlace operation, NTSC/PAL is set to 38.25MHz.
[0047] When an aspect ratio is the still picture image pck-up of 4:3, the pixel information on this effective pixel field 31 will be used as it is. Moreover, in order to realize a monitor ring mode at the time of a still picture image pck-up, at an NTSC color TV system, 480 lines is realized by performing 1/3.0 compression to 1440 lines, and a PAL system realizes 576 lines by performing 1/2.5 compression to 1440 lines.
[0048] When an aspect ratio is the animation image pck-up of 4:3, in an NTSC color TV system, 1/2.5 compression will be performed to 1213 lines. At this time, vertical a total of 227 (=1440-1213) lines of an effective pixel field will be used for hand deflection amendment, and the rate becomes about 19%. In a PAL system, 1/2.0 compression will be performed to 1150 lines. At this time, a part for 290 (=1440-1150) lines will be used for hand deflection amendment,

and the rate becomes about 25%.
[0049] When an aspect ratio is the animation image pck-up of 16:9 (HDTV), 1920 and the number of perpendicular pixels (the number of lines) serve as [the number of level pixels] an effective pixel field of 1080. And in an NTSC color TV system, 1/2.0 compression will be performed to 970 lines. At this time, use becomes ****** to hand deflection amendment about vertical a total of 110 (=1080-970) lines of an effective pixel field, and the rate becomes about 11%. In a PAL system, 1/1.5 compression will be performed to 863 lines. At this time, a part for 217 (=1080-863) lines will be used for hand deflection amendment, and the rate becomes about 25%.
[0050] The case of 1/2.0 and 1/2.5 is taken for an example among the compressibility 1/3.0 mentioned above, 1/2.5, 1/2.0, and 1/1.5, and the concrete compression (addition) operation is explained.
[0051] First, interlace operation of the 1/2.0 compression by the NTSC color TV system is explained using the timing chart of drawing 11 based on explanatory drawing of drawing 10 of operation. In this 1/2.0 compression, the signal charge between 2 pixels of slant is added within perpendicular CCD12, the signal charge of every two lines added 2 pixels is shifted to level CCD14 in order as a signal charge for one line (two-line shift), and the signal charge for 2 line (4 pixels) is added within this level CCD14.
[0052] Specifically, a signal charge is read from each sensor section (pixel) 11 in the 1st field by reading to the perpendicular transfer clock Vphi1 and Vphi3, and standing Pulse XSG in a perpendicular blanking period (V-BLK), first. In the case of read-out of this signal charge, the signal charge of each pixel of the 1st line and the signal charge of each pixel diagonally across to the right of the 2nd line are added in perpendicular CCD12, the signal charge of each pixel of the 3rd line and the signal charge of each pixel diagonally across to the right of the 4th line are added, and 2 pixel addition of slanting is performed to flume ****** every two lines at it.
[0053] Then, about the signal charge of the unnecessary pixel field of the effective pixel field bottom (level CCD14 side) in an NTSC color TV system, operation swept and thrown away is performed by carrying out the transfer drive of perpendicular CCD12 at high speed. It high-speed-sweeps, and throws away and operation can be realized by [this] using well-known technology. Then, line shift operation of every two lines is repeated and performed. By performing this line shift for two lines, addition of the signal charge for a total of 4 pixels per two lines and 1 train is performed in level CCD14.
[0054] From level CCD14, first by this (?+M21)+ (?+M41), (G11+C22) +(G31+C42) (Y12+G23)+ (Y32+G43), (M13+C24) + (M33+C44), --, then (?+M61)+ (?+M81), (G51+C62) The signal charge for 4 pixels added to the condition + (G71+C82), (Y52+G63) +(Y72+G83) (M53+C64)+ (M73+C84), and .... is outputted in order.
[0055] 1/2.0 compression in the 1st field is performed by the repeat of a series of operation mentioned above. Here, it expresses the color-difference signal Cb that having attached the underline does not attach an underline for a color-difference signal Cr, respectively. Moreover, in explanatory drawing of drawing 10 of operation, every four lines which attached O mark and - mark become the combination to which a signal charge is added in the 1st field, and the line center of gravity after addition serves as a position which attached <> mark.
[0056] Also in the case of the 2nd field, 1/2.0 compression is performed by the same operation as the case of the 1st field. However, in the 2nd field, in explanatory drawing of drawing 10 of operation, every four lines which attached ** mark become the combination to which a signal charge is added, and the line center of gravity after addition serves as a position which attached x mark. In addition, about one line of the beginning, since addition for 4 pixels is not performed, it will be swept and thrown away.
[0057] From level CCD14, first by this (?+M41)+ (?+M61), (G31+C42) +(G51+C62) (Y32+G43)+ (Y52+G63), (M33+C44) + (M53+C64), --, then (?+M81)+ (?+M101), (G71+C82) The signal charge for 4 pixels added to the condition + (G91+C102), (Y72+G83) +(Y92+G103) (M73+C84)+ (M93+C104), and .... is outputted in order.
[0058] In addition, although [this example / the 1st field and the 2nd field / pixel / one certain] 2 pixel addition of slanting is performed between diagonally right (diagonal below) pixels As stated based on explanatory drawing of drawing 8 of operation, in the 2nd field About one certain pixel, it may be made to perform 2 pixel addition of slanting between diagonally left (diagonal below) pixels, and the 1st field and the 2nd field may be made to perform 2 pixel addition of slanting between diagonally left (diagonal below) pixels.
[0059] Next, interlace operation of the 1/2.5 compression by the NTSC color TV system is explained using the timing chart of drawing 13 based on explanatory drawing of drawing 12 of operation. In this 1/2.5 compression, 2 pixel addition of slanting is performed within perpendicular CCD12, two lines / shift for three lines (a two-line shift / three-line shift) is repeated for the signal charge added 2 pixels by turns to level CCD14 as a signal charge for one line, and addition of the signal charge for a two-line (4 pixels) part / 3 line (6 pixels) is repeated and performed within this level CCD14.
[0060] Specifically, a signal charge is read from each sensor section (pixel) 11 in the 1st field by reading to the perpendicular transfer clock Vphi1 and Vphi3, and standing Pulse XSG in a perpendicular blanking period (V-BLK),

first. In the case of read-out of this signal charge, the signal charge of each pixel of the 1st line and the signal charge of each pixel diagonally across to the right of the 2nd line are added in perpendicular CCD12, the signal charge of each pixel of the 3rd line and the signal charge of each pixel diagonally across to the right of the 4th line are added, and 2 pixel addition of slanting is performed to flume ****** every two lines at it.

[0061] Then, about the signal charge of the unnecessary pixel field of the effective pixel field bottom (level CCD14 side) in an NTSC color TV system, operation swept and thrown away is performed by carrying out the transfer drive of perpendicular CCD12 at high speed. The signal charge for two-line a total of 4 pixels is first added in level CCD14 after that by performing line shift operation about the signal charge for two lines. Then, the signal charge for a total of 6 pixels per three lines and 1 train is added in level CCD14 by performing line shift operation about the following signal charge for three lines.

[0062] From level CCD14, first by this (?+M21)+ (?+M41), (G11+C22) +(G31+C42) (Y12+G23)+ (Y32+G43), -- then (?+M61)+(?+M81)+ (?+M101), (G51+C62)+(G71+C82)+ (G91+C102), (Y52+G63) +(Y72+G83)+ (Y93+G103), ..., then (?+M121) +(?+M141) (G111+C122)+ (G131+C142), (Y112+G123) The signal charge for added 4 pixels and the signal charge for 6 pixels are repeatedly outputted to the condition + (Y132+G143) and --, for every Rhine.

[0063] Compression in the 1st field is performed by the repeat of a series of operation mentioned above. Here, it expresses the color-difference signal Cb that having attached the underline does not attach an underline for a color-difference signal Cr, respectively. Moreover, in explanatory drawing of drawing 12 of operation, every six lines which attached every four lines and - mark which attached O mark become the combination to which a signal charge is added in the 1st field, and the line center of gravity after addition serves as a position which attached <> mark.

[0064] Also in the case of the 2nd field, compression is performed by the same operation as the case of the 1st field. However, in the 2nd field, in explanatory drawing of drawing 12 of operation, every six lines which attached every four lines and ** mark which attached ** mark become the combination to which a signal charge is added, and the line center of gravity after addition serves as a position which attached x mark. In addition, about one line of the beginning, since 4 pixels or addition for 6 pixels is not performed, it will be swept and thrown away. And 1/2.5 compression is realized in the 2 field. That is, 10 pixels is compressed into one half in one field, and since it is performed in the 2 fields, it becomes 1/2.5 (=10/4) compression.

[0065] From level CCD14, first by this (?+M41)+ (?+M61), (G31+C42) +(G51+C62) (Y32+G43)+ (Y52+G63), --, then (?+M81)+(?+M101)+ (?+M121), (G71+C82) +(G91+C102)+ (G111+C122), (Y72+G83) +(Y92+G103)+ (Y112+G123), ..., then (?+M141) +(?+M161) (G131+C142)+ (G151+C162), (Y132+G143) The signal charge for added 4 pixels and the signal charge for 6 pixels are repeatedly outputted to the condition + (Y152+G163) and --, for every Rhine.

[0066] In addition, although [this example / the 1st field and the 2nd field / pixel / one certain] 2 pixel addition of slanting is performed between diagonally right (diagonal below) pixels In the 2nd field, it may be made to perform 2 pixel addition (to see drawing 8) of slanting between diagonally left (diagonal below) pixels about one certain pixel. Moreover, the 1st field and the 2nd field may be made to perform 2 pixel addition of slanting between diagonally left (diagonal below) pixels.

[0067] However, since the signal charge for added 4 pixels and the signal charge for 6 pixels are repeatedly outputted for every Rhine in operation of the 1/2.5 compression mentioned above, while the line center of gravity changes between the fields, the amount of signals will change for every Rhine. The difference between the fields of the line center of gravity is [some], and even if it amends from an up-and-down line, it does not become remarkable quality-of-image degradation. However, in a latter digital disposal circuit, it is necessary to perform gain control for every Rhine about the amount of signals.

[0068] Then, operation of the 1/2.5 compression it was made not to change the amount of signals for every Rhine is explained based on explanatory drawing of drawing 14 of operation.

[0069] In this example, it added about the signal charge for four lines, and infanticide operation was performed about the following signal charge for one line, it added about the following signal charge for four lines, infanticide operation was performed about the following signal charge for one line, and 1/2.5 compression is realized by repeating 4-pixel addition and infanticide in the condition --. Here, infanticide operation shall mean operation which does not read a signal charge in a specific line.

[0070] Specifically, a signal charge is read every other line by making four lines into a unit from each sensor section (pixel) 11, and read-out of a signal charge is thinned out by five lines at a rate of one line in the 1st field. At this time, about the read signal charge, the signal charge of each pixel of the 1st line and the signal charge of each pixel diagonally across to the right of the 2nd line are added in perpendicular CCD12, the signal charge of each pixel of the 3rd line and the signal charge of each pixel diagonally across to the right of the 4th line are added, and 2 pixel addition of slanting is performed to flume ****** every two lines.

[0071] Then, the signal charge for a total of 4 pixels per two lines and 1 train is added in level CCD14 by performing line shift operation continuously about the signal charge for two lines to which 2 pixel addition of slanting was performed. Thereby, from level CCD14, the signal charge for 4 pixels added to the condition (?+M21)+ (?+M41) and (G11+C22) +(G31+C42) (Y12+G23)+ (Y32+G43) and -- is outputted in order.
[0072] Since it is thinned out about the following signal charge for one line, even if 2 pixel addition of slanting is performed among the 1st line of the beginning of four lines as follows in perpendicular CCD12, the first signal charge of the 1st line is accumulated as an addition result as it is. Moreover, about the following signal charge for four lines, 2 pixel addition of slanting is performed between the 2nd line and the 3rd line. And about the last line, 2-pixel addition is performed between the lines thinned out by the degree, and the signal charge of the last line is accumulated as an addition result as it is.
[0073] And the signal charge for a total of 4 pixels per three lines and 1 train is added in level CCD14 by performing line shift operation continuously about this signal charge for three lines. Thereby, from level CCD14, the signal charge for 4 pixels added to the condition (M61)+(?+M81)+ (?), (C62)+(G71+C82)+ (G91), (G63)+(Y72+G83)+ (Y92), and -- is outputted in order.
[0074] Compression in the 1st field is performed by the repeat of a series of operation mentioned above. Here, it expresses the color-difference signal Cb that having attached the underline does not attach an underline for a color-difference signal Cr, respectively. Moreover, in explanatory drawing of drawing 14 of operation, every four lines which attached O mark and - mark become the combination to which a signal charge is added in the 1st field, and the line center of gravity after addition serves as a position which attached <> mark.
[0075] Also in the case of the 2nd field, compression is performed by the same operation as the case of the 1st field. However, in the 2nd field, in explanatory drawing of drawing 14 of operation, every four lines which attached ** mark and ** mark become the combination to which a signal charge is added, and the line center of gravity after addition serves as a position which attached x mark. In addition, about one line of the beginning, since addition for 4 pixels is not performed, it will be swept and thrown away. And 1/2.5 compression is realized in the 2 field.
[0076] From level CCD14, first by this (?+M41)+ (?+M61), (G31+C42) +(G51+C62) (Y32+G43)+ (Y52+G63), -- then (M81)+(?+M101)+ (?), (C82)+(G91+C102)+ (G111), (G83) +(Y92+G103)+ (Y112), ..., then (?+M141)+ (?+M161), The signal charge for 4 pixels added to the condition (G131+C142) +(G151+C162) (Y132+G143)+ (Y152+G163) and -- is outputted one by one.
[0077] As mentioned above, the signal charge for added 4 pixels is outputted for every Rhine by performing 1/2.5 compression which used infanticide operation together. Therefore, since the amount of signals does not change for every Rhine, complicated signal processing of performing gain control for every Rhine in a latter digital disposal circuit needs to be performed.
[0078] In addition, although [this example / the 1st field and the 2nd field / pixel / one certain] 2 pixel addition of slanting is performed between diagonally right (diagonal below) pixels In the 2nd field, it may be made to perform 2 pixel addition (to see drawing 8) of slanting between diagonally left (diagonal below) pixels about one certain pixel. Moreover, the 1st field and the 2nd field may be made to perform 2 pixel addition of slanting between diagonally left (diagonal below) pixels.
[0079] Infanticide operation used by the 1/2.5 compression mentioned above is easily realizable with well-known technology. Specifically, two perpendicular transfer clocks Vphi1, Vphi1' and Vphi3, and Vphi3' are prepared as a perpendicular transfer clock of eye one phase the read-out pulse XSG stands, and a three-phase-circuit eye so that clearly from the plugging chart of the pixel section of drawing 15 . And the read-out pulse XSG shall not stand about perpendicular transfer clock Vphi1' and Vphi3'.
[0080] Furthermore, corresponding to six kinds of perpendicular transfer clocks Vphi1, Vphi1', Vphi2, Vphi3, Vphi3', and Vphi4, pattern wiring of the six clock lines 41-46 is carried out. The clock line 42 which transmits perpendicular transfer clock Vphi1' or Vphi3', or 45 is made to wire about the line which culls out at this time. What is necessary is just to wire the clock line 42 and the clock line 45 every other line about the line to thin out in the 1/2.5 compression explained by drawing 14 . In the example of wiring of drawing 15 , impress perpendicular transfer clock Vphi1' to the transfer electrode 22-1 of the n+2nd line, it is made to impress perpendicular transfer clock Vphi3' to the transfer electrode 22-3 of the n-3rd line, the n-3rd line thins out with the n+2nd line, and it becomes an object line.
[0081] In the mode in which infanticide operation is not performed, and by giving the perpendicular transfer clock Vphi1, Vphi2, Vphi3, and Vphi4 to the transfer electrode 22-1, 22-2, 22-3, and 22-4 through circuit patterns 41, 43, 44, and 46 With the perpendicular transfer clock Vphi1, since it reads to phi 3 and Pulse XSG stands, while a signal charge is read from all the sensor sections 11 to perpendicular CCD12, 2 pixel addition of V slanting which carried out point ** within perpendicular CCD12 is performed.
[0082] On the other hand in the mode in which infanticide operation is performed, by giving the perpendicular transfer

clock Vphi1, Vphi2, Vphi3, and Vphi4 to the transfer electrode 22-1, 22-2, 22-3, and 22-4 through circuit patterns 41, 43, 44, and 46 In the line to which these perpendicular transfer clock Vphi1' and Vphi3' are impressed since it reads to perpendicular transfer clock Vphi1' and Vphi3' and Pulse XSG does not stand While read-out of a signal charge is not performed but read-out of a signal charge is performed only in the other line, 2 pixel addition of slanting which carried out point ** within perpendicular CCD12 is performed.

[0083] As mentioned above, although the example of operation at the time of using a complementary color filter as a light filter 19 was explained, this invention is not restricted to application in a complementary color filter, and can be applied also like a primary color filter. Hereafter, the example of operation at the time of using a primary color filter as a light filter 19 is explained. Four kinds of examples of color coding of primary color filter 19-3(A) -19-6(B) are shown in drawing 16 .

[0084] In drawing 16 , the primary color filter 19-3 (A) is a R/G/B slanting stripe array, and, as for the direction of V / the direction of H, R/B serves as [G] color coding of 4 repeats [direction / the direction of V (perpendicular) / / of H (level) / two]. The primary color filter 19-4 (B) is a G/R/B check array, and, as for the direction of V / the direction of H, each color serves as color coding of 4 repeats.

[0085] The primary color filter 19-5 (C) is a G slanting stripe R/B check array, and R/B serves as [G / direction / the direction of V / / of H / two] color coding of direction of H 4 repeat / direction of V 2 /. The primary color filter 19-6 (D) is a G/R/B check array, and each color serves as color coding of direction of H 4 repeat [direction of V 2].

[0086] By performing 2 pixel addition (mixture) of slanting like the case of a complementary color filter here in CCD image sensor 10 using the primary color filter 19-3 (A), the same color is added, namely, a signal charge is added between 2 pixels of slant of G, G, R, and R, B and B. Consequently, as shown in drawing 17 , primary color is held and after the 2 pixel addition of slanting serves as color coding of G length stripe and a R/B check array. In addition, in drawing 17 , addition shall be performed between 2 pixels of slant which the black dot shows the pixel typically and is shown by the arrow.

[0087] Thus, if it uses by holding primary color by 1/2PS (progressive scan; all pixel independent read-out) compression (i.e., if the information added 2 pixels of slant is used as it is), since the primary color separation processing by the latter signal-processing system will become unnecessary, after slanting addition has a merit in respect of the circuit scale of resolution or a signal-processing system.

[0088] On the other hand, it becomes the following operation when it uses by 1 / 4information-separator (interlace scan) compression. the signal charge added 2 pixels of slant in 1 / 4information-separator compression -- as the signal charge for one line -- dealing with it -- as a four-line unit -- perpendicular addition -- carrying out (one bit shift also being performed if needed at this time) -- the combination of four lines is changed in the 1st field and the 2nd field

[0089] 1 / 4information-separator compression is explained using explanatory drawing of drawing 18 of operation. In drawing 18 , (A) shows the case of the 1st field, (B) shows the case of the 2nd field, respectively, in the 1st field (A), 1st line - the 4th line, 5th line - the 8th line, and -- are combination, and the combination of 3rd line - the 6th line, 7th line - the 10th line, and -- performs perpendicular addition in the 2nd field (B).

[0090] First, in the 1st field (A), one bit shift which carries out a line shift at level CCD14, and subsequently transmits only the 1 bit (G, B, G, R, --) (one step) of the signal charges of the 1st line by level CCD14 is performed, and the line shift of the signal charge (G, R, G, B, --) of the 2nd line is carried out continuously at level CCD14. Thereby, within level CCD14, two-line 1 bit-shift addition is performed, and it becomes B+G, G+R, R+G, G+B, and --, and -- and since it is B+G=Cy and G+R=Ye, the addition result becomes --, Cy, Ye, Ye and Cy, and --.

[0091] In this state, the signal charge (G, B, G, R, ...) of the 3rd line and the signal charge of two lines of the 4th line (G, R, G, B, ..) are shifted to level CCD14. Thereby, within level CCD14, addition of the signal charge for 4 line (8 pixels) is performed. At this time, the addition result becomes 2G, B+R, 2G, R+B, 2G, and -- by the 3rd line and two-line addition of the 4th line, and since it is B+R=Mg, it becomes 2G, Mg, 2G, Mg, 2G, and --.

[0092] And in addition of the signal charge for 4 line (8 pixels) to 1st line - the 4th line, the addition result becomes 2 G+Cy, Mg+Ye, 2 G+Ye, Mg+Cy, and --, as shown in drawing 18 (A). In addition, C and Mg are written as M and Ye is written [the inside of drawing, and 2G] for G and Cy as Y. The level transfer of these signal charges is carried out by level CCD14 at order, they are changed into a signal level by the charge detecting element 16, and are outputted to a latter signal-processing system.

[0093] In addition of the signal charge for four lines to 5th line - the following line [8th], the signal charge (G, B, G, R, ...) of the 5th line and the signal charge of two lines of the 6th line (G, R, G, B, ..) are first shifted to level CCD14. Thereby, within level CCD14, two-line addition is performed, and it becomes B+R, 2G, R+B, 2G, and --, and -- and since it is R+B=Mg, the addition result becomes --, Mg, 2G, Mg, 2G, and --.

[0094] In this state, after carrying out the line shift of the signal charge (G, B, G, R, ...) of the 7th line at level CCD14 and performing one bit shift subsequently, the line shift of the signal charge (G, R, G, B, ..) of the 8th line is carried out

at level CCD14. Thereby, within level CCD14, addition of the signal charge for four lines to 5th line - the 8th line is performed. At this time, two-line 1 bit-shift addition is performed between the 7th line and the 8th line.

[0095] It becomes B+G, G+R, R+G, G+B, and --, and -- and since it is B+G=Cy and G+R=Ye, the addition result by the two-line 1 bit-shift addition between the 7th line and the 8th line becomes --, Cy, Ye, Ye and Cy, and --. And the addition result of the signal charge for four lines to 5th line - the 8th line becomes Mg+Cy, 2 G+Ye, Mg+Ye, 2 G+Cy, and --, as shown in drawing 18 (A). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system. Henceforth, the same operation is repeated in the 1st field.

[0096] Next, operation in the 2nd field (B) is explained. First, the signal charge (G, B, G, R, ...) of the 3rd line and the signal charge of two lines of the 4th (G, R, G, B, ..) line are shifted to level CCD14. Thereby, within level CCD14, two-line addition is performed, and it becomes 2G, R+B, 2G, B+R, and --, and -- and since it is R+B=Mg, the addition result becomes --, 2G, Mg, 2G, Mg, and --.

[0097] In this state, after carrying out the line shift of the signal charge (G, B, G, R, ...) of the 5th line at level CCD14 and performing one bit shift subsequently, the line shift of the signal charge (G, R, G, B, ..) of the 6th line is carried out at level CCD14. Thereby, within level CCD14, addition of the signal charge for four lines to 3rd line - the 6th line is performed. At this time, two-line 1 bit-shift addition is performed between the 5th line and the 6th line.

[0098] It becomes G+R, R+G, G+B, B+G, and --, and -- and since it is G+R=Ye and G+B=Cy, the addition result by the two-line 1 bit-shift addition between the 5th line and the 6th line becomes --, Ye, Ye, Cy and Cy, and --. And the addition result of the signal charge for four lines to 2nd line - the 5th line becomes 2 G+Ye, Mg+Ye, 2 G+Cy, Mg+Cy, and --, as shown in drawing 18 (B). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system.

[0099] In addition of the signal charge for four lines to 7th line - the 10th line, after carrying out the line shift of the signal charge (G, B, G, R, --) of the 7th line at level CCD14 and performing one bit shift subsequently, the line shift of the signal charge (G, R, G, B, --) of the 8th line is carried out at level CCD14. Thereby, within level CCD14, two-line 1 bit-shift addition is performed, and it becomes G+R, R+G, G+B, B+G, and --, and -- and since it is G+R=Ye and G+B=Cy, the addition result becomes --, Ye, Ye, Cy and Cy, and --.

[0100] In this state, the signal charge (G, B, G, R, ...) of the 9th line and the signal charge of two lines of the 10th line (G, R, G, B, ..) are shifted to level CCD14. Thereby, within level CCD14, addition of the signal charge for four lines is performed. At this time, the addition result becomes B+R, 2G, R+B, 2G, and -- by the 9th line and two-line addition of the 10th line, and since it is B+R=Mg, it becomes Mg, 2G, Mg, 2G, and --.

[0101] And in addition of the signal charge for 4 line (8 pixels) to 7th line - the 10th line, the addition result becomes Mg+Ye, 2 G+Ye, Mg+Cy, 2 G+Cy, and --, as shown in drawing 18 (B). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system. Henceforth, the same operation is repeated in the 2nd field.

[0102] the color difference dot order which is outputted by performing 1 / 4information-separator compression by the four-line addition including the 2 pixel addition of slanting, and 1 bit-shift addition in the CCD image sensor using the primary color filter 19-4 of color coding shown in drawing 16 (A) as mentioned above and with which the color-difference signal Cb (Cy+Mg, Ye+G) and the color-difference signal Cr (Mg+Ye, G+Cy) were located in a line by turns for every Rhine -- the following signal will be acquired

[0103] About signal processing after changing into the complementary color (G, Ye, Mg, Cy) from primary color (R, G, B), since the spectral characteristic and signal level differ from a general complementary color check, to perform signal processing of the following primary color separation, and what is necessary is just made to perform processing equivalent to an after that usual primary color array.

[0104] Mg+Cy (it is hereafter described as MC) and G+Ye (it is hereafter described as GY) are color-difference signals Cb, G+Cy (it is hereafter described as GC) and Mg+Ye (it is hereafter described as MY) are color-difference signals Cr, and the RGB code contained in these color-difference signals Cb and Cr is MC=R+G+2BGY= R+3GGC=3 G+BMY=2 R+G+B.

[0105] Therefore, when it asks for a RGB primary signal by the operation again from these color-difference signals, it is G={3(GC+GY)-(MC-MY)}/16={3 (3 G+B+R+3G).

- (R+G+2B+2 R+G+B) It is set to}/16R=(MY-GC+2G)/2={(2 R+G+B)-(3 G+B)+2G} / 2B=(MC-GY+2G)/2= {(R+G+2B)-(R+3G)+2G} / 2.

[0106] About a luminance signal Y, it can make from adding the color-difference signal of each line, using G of an upper formula as it is simply from 2 Y=MC+GY=GC+MY=4G+2R+2B. In addition, in this formula, Y of 2Y shall express a luminance signal and GY and Y of MY shall express Ye, respectively.

[0107] Next, the case where the primary color filter 19-4 of color coding shown in drawing 16 (B) is used is explained.

In this case, G, G, B and G, R, and B, G and R are added by performing 2 pixel addition of slanting, respectively. Consequently, as shown in drawing 19 , it becomes color coating of a complementary color array. In addition, Y and Mg are written as M and Cy is written for the inside of drawing, and Ye as C.

[0108] In color coating of this complementary color array, 1 / 2information-separator compression is performed as follows. Also in this case, the combination of two lines to add is changed in the 1st field and the 2nd field. 1 / 2information-separator compression is explained using explanatory drawing of drawing 20 of operation. In this drawing, (A) shows the case of the 1st field, (B) shows the case of the 2nd field, respectively, in the 1st field (A), the 1st line, the 2nd line, the 3rd line, the 4th line, and -- are combination, and the combination of the 2nd line, the 3rd line, the 5th line, and -- performs a two-line shift with the 4th line in the 2nd field (B).

[0109] First, in the 1st field (A), the line shift of the signal charge (G, Cy, Mg, Ye, --) of the 1st line is carried out at level CCD14, and subsequently the line shift of the signal charge (Mg, Ye, G, Cy, --) of the 2nd line is continuously performed one bit shift and carried out by level CCD14 at level CCD14. Thereby, within level CCD14, two-line 1 bit-shift addition is performed, and the addition result becomes Cy+Mg, Mg+Ye, Ye+G, G+Cy, and --, as shown in drawing 20 (A). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system.

[0110] Then, the line shift of the signal charge (G, Cy, Mg, Ye, --) of the 3rd line is carried out, and after performing one bit shift subsequently, the line shift of the signal charge (Mg, Ye, G, Cy, --) of the 4th line is carried out at level CCD14. Thereby, two-line 1 bit-shift addition is performed, and the addition result becomes Cy+Mg, Mg+Ye, Ye+G, G+Cy, and --, as shown in drawing 20 (A). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system. Henceforth, the same operation is repeated in the 1st field.

[0111] Next, in the 2nd field (B), the line shift of the signal charge (Mg, Ye, G, Cy, --) of the 2nd line is carried out at level CCD14, and subsequently the line shift of the signal charge (G, Cy, Mg, Ye, --) of the 3rd line is continuously performed one bit shift and carried out by level CCD14 at level CCD14. Thereby, within level CCD14, two-line 1 bit-shift addition is performed, and the addition result becomes Ye+G, G+Cy, Cy+Mg, Mg+Ye, and --, as shown in drawing 20 (B). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system.

[0112] Then, the line shift of the signal charge (Mg, Ye, G, Cy, --) of the 4th line is carried out, and after performing one bit shift subsequently, the line shift of the signal charge (G, Cy, Mg, Ye, --) of the 5th line is carried out at level CCD14. Thereby, two-line 1 bit-shift addition is performed, and the addition result becomes Ye+G, G+Cy, Cy+Mg, Mg+Ye, and --, as shown in drawing 20 (B). The level transfer of these signal charges is carried out at order, they are changed into a signal level, and are outputted to a latter signal-processing system. Henceforth, the same operation is repeated in the 2nd field.

[0113] the color difference dot order which is outputted by performing 1 / 2information-separator compression by the 2 pixel addition of slanting, and two-line 1 bit-shift addition in the CCD image sensor using the primary color filter 19-4 of color coding shown in drawing 16 (B) as mentioned above and with which the color-difference signal Cb (Cy+Mg/Ye+G) and the color-difference signal Cr (Mg+Ye/G+Cy) were located in a line by turns for every Rhine -- the following signal will be acquired

[0114] In addition, in this example, although the case of 1 / 2information-separator compression was explained, in 1/2PS compression, it becomes complementary color independent read-out from which the signal charge of the complementary color (G, Ye, Mg, Cy) obtained by the 2 pixel addition of slanting is read independently.

[0115] Next, the case where the primary color filter 19-5 of color coding shown in drawing 16 (C) is used is explained. In this case, G, G, B, and B, R and R are added by performing 2 pixel addition of slanting. Consequently, as shown in drawing 21 (A) and (B), primary color is held and after slanting addition serves as color coding of the primary color length stripe by which each color is arranged in the shape of a stripe by making G, B, G, and R into a unit.

[0116] In addition, in case 2 pixel addition of slanting is performed, the combination of a line will be changed in the 1st field and the 2nd field. In drawing 21 , (A) shows the case of the 1st field and (B) shows the case of the 2nd field, respectively. In the 1st field, 2 pixel addition of slanting is performed between diagonally right (diagonal below) pixels about a certain pixel, and 2 pixel addition of slanting is performed between diagonally left (diagonal below) pixels about a certain pixel in the 2nd field.

[0117] Thus, in the CCD image sensor using the primary color filter 19-5 of color coding shown in drawing 16 (C), since the result of the 2 pixel addition of slanting can add the arbitrary numbers of lines by color coding and the bird clapper of a primary color length stripe at the time of the addition in level CCD14, arbitrary compressibility is realizable. Moreover, since after slanting addition is primary color, there is no need for the primary color separation in a latter signal-processing system, and the circuit scale of a signal-processing system is small, and ends.

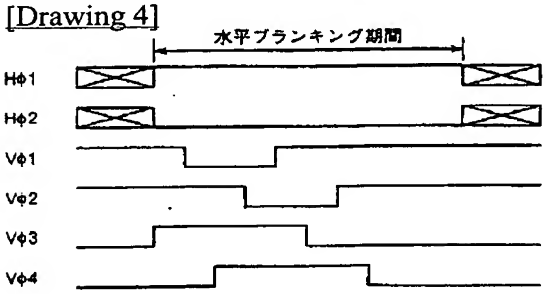
[0118] Especially, to a primary color check array, since it is only that level 4 repeats fall with 4, only R/B has the advantage that the fall of the resolution at the time of carrying as an image pickup device can be suppressed low in a digital still camera. Moreover, since there are few falls of the resolution by signal processing like color difference line sequential if perpendicular, it becomes advantageous when obtaining high compressibility.
[0119] Next, the case where the primary color filter 19-6 of color coding shown in drawing 16 (D) is used is explained. In this case, G, G, B, B and R, and B, G and R are added by performing 2 pixel addition of slanting. Consequently, as shown in drawing 22 (A) and (B), it becomes color coding of the complementary color length stripe by which each color is arranged in the shape of a stripe by making G, Cy, Mg, and Ye into a unit.
[0120] Also in this case, in case 2 pixel addition of slanting is performed, the combination of a line will be changed in the 1st field and the 2nd field. In drawing 22 , (A) shows the case of the 1st field and (B) shows the case of the 2nd field, respectively. In the 1st field, 2 pixel addition of slanting is performed between diagonally right (diagonal below) pixels about a certain pixel, and 2 pixel addition of slanting is performed between diagonally left (diagonal below) pixels about a certain pixel in the 2nd field.
[0121] Thus, in the CCD image sensor using the primary color filter 19-6 of color coding shown in drawing 16 (D), since the result of the 2 pixel addition of slanting can add the arbitrary numbers of lines at the time of the addition [by color coding and the bird clapper of a complementary color length stripe] in level CCD14 like the case of a primary color length stripe, arbitrary compressibility is realizable.
[0122] Drawing 23 is the block diagram showing an example of the camera structure of a system concerning this invention using the CCD image sensor concerning this operation form as an image pickup device.
[0123] This camera system has the composition of having the digital disposal circuit 55 which makes various kinds of signal processing to the output signal of CCD image sensor 51, the lens 52 which constitutes some optical system, the CCD drive circuit 53 which drives CCD image sensor 51, the image pck-up mode setting section 54 which sets up image pck-up mode, and CCD image sensor 51.
[0124] CCD image sensor 51 is equipped [level 4 / level 4] with the light filter 56 with primary color color coding of perpendicular 2 repeat which is shown in drawing 2 (A) and (B), which is shown in complementary color color coding of perpendicular 2 repeat, drawing 16 (A), and (B) and which is shown in primary color color coding of perpendicular 4 repeat or drawing 16 (C), and (D) / level 4 /.
[0125] In the camera system of this composition, image formation of the incident light (****) from a photographic subject (not shown) is carried out on the image pck-up side of CCD image sensor 51 through a light filter 56 with the lens 52 of optical system. As CCD image sensor 51, it is the many pixels corresponding to the still picture image pck-up, and the thing of the pixel composition shown in drawing 1 is used. This CCD image sensor 51 is driven by the CCD drive circuit 53 according to the image pck-up mode set up in the image pck-up mode setting section 54.
[0126] Here, in the image pck-up mode setting section 54, a setup in still picture mode and animation mode is possible, and a setup in the image pck-up mode corresponding to each television system, such as NTSC/PAL/HD, is still more possible about animation mode. The CCD drive circuit 53 is read only to the perpendicular transfer clock Vphi3 at the drive same when still picture mode is set up in the image pck-up mode setting section 54 as frame read-out of common knowledge of CCD image sensor 51, i.e., the 1st field, it reads only to the perpendicular transfer clock Vphi1 in the 2nd field, Pulse XSG is stood, and each drive of read-out of the signal charge from each pixel, a perpendicular transfer, and a level transfer is performed.
[0127] When animation mode is set up in the image pck-up mode setting section 54, in order to make the television signal corresponding to each television system, such as NTSC/PAL/HD, further by the down conversion by the addition compression from CCD image sensor 51 of the many pixels for still pictures, the CCD drive circuit 53 drives CCD image sensor 51 so that the compression corresponding to each television system which carried out point **, i.e., the perpendicular compression based on the 2 pixel addition of slanting, may be realized. Perpendicular compression processing is performed holding color-difference signals Cr and Cb by operation with this animation mode, as point ** was carried out, and down conversion to the television signal corresponding to each television system is performed.
[0128] The camera system which can respond to the both sides of a still picture image pck-up and an animation image pck-up by one CCD image sensor 51 is realizable with the above. Thereby, the monitoring of the television picture of an NTSC color TV system or a PAL system becomes possible by using the multi-pixel CCD image sensor for digital still cameras as an image pickup device, without reducing a pixel. Especially, in CCD image sensor 51, arbitrary perpendicular compression can obtain eye a possible hatchet and the animation which was able to balance horizontal and vertical resolution.
[0129]
[Effect of the Invention] As explained above, according to this invention, each signal charge of the pixel group located every party among two or more pixels is read to the perpendicular transfer section located in left-hand side. Since

addition of the signal charge between 2 pixels of slant is attained in perpendicular transfer circles by reading and coming out of it and having been made to make each signal charge of the pixel group located every parties of other into the perpendicular transfer section located in right-hand side, the animation image pck-up which was able to balance level and the vertical definition is attained.

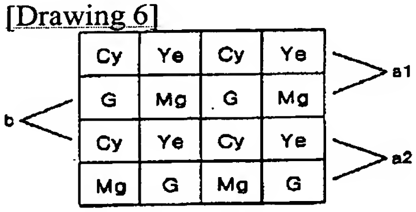
[Translation done.]

DRAWINGS

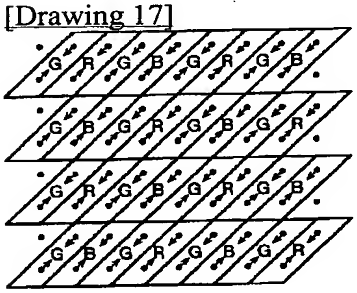
[Drawing 4]



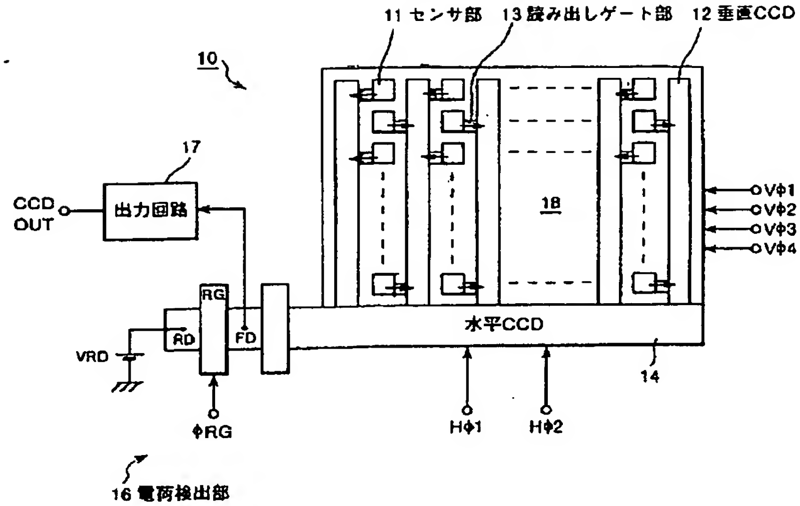
[Drawing 6]



[Drawing 17]



[Drawing 1]



[Drawing 2]

19-1

M	C	G	C	M	C	G	C
G	Y	M	Y	G	Y	M	Y
M	C	G	C	M	C	G	C
G	Y	M	Y	G	Y	M	Y

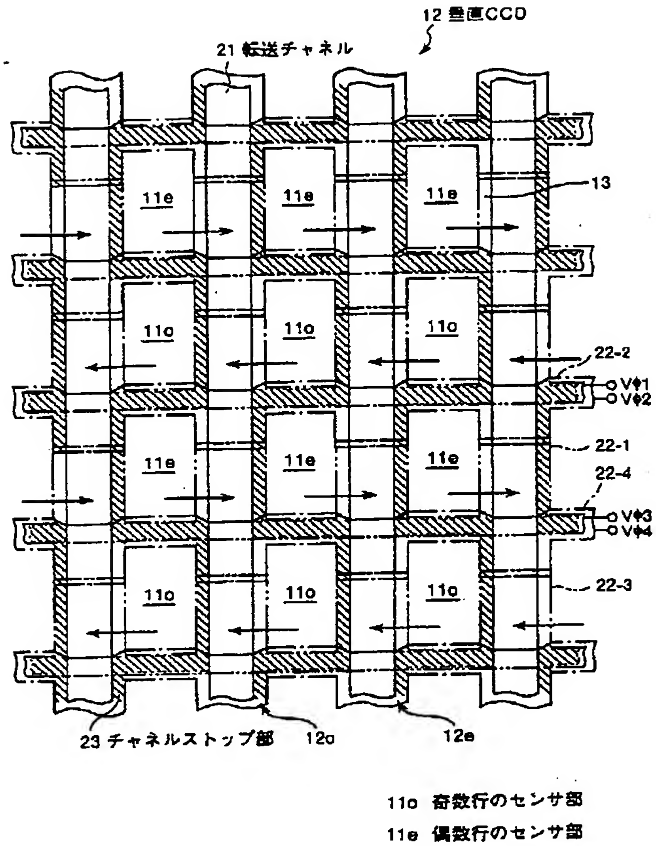
(A)

19-2

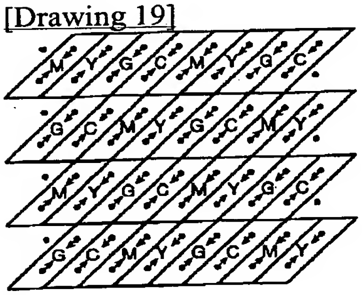
M	C	G	Y	M	C	G	Y
G	Y	M	C	G	Y	M	C
M	C	G	Y	M	C	G	Y
G	Y	M	C	G	Y	M	C

(B)

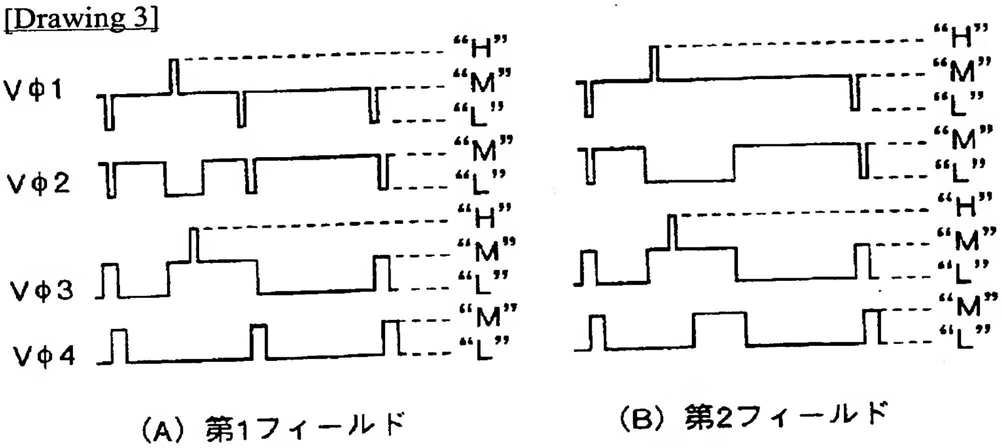
[Drawing 5]



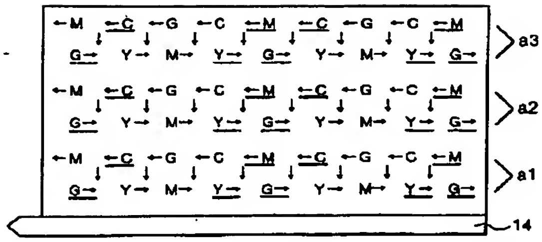
[Drawing 19]



[Drawing 3]

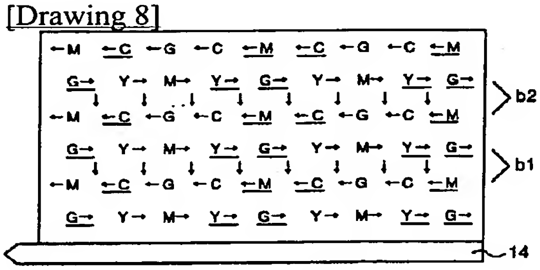


[Drawing 7]



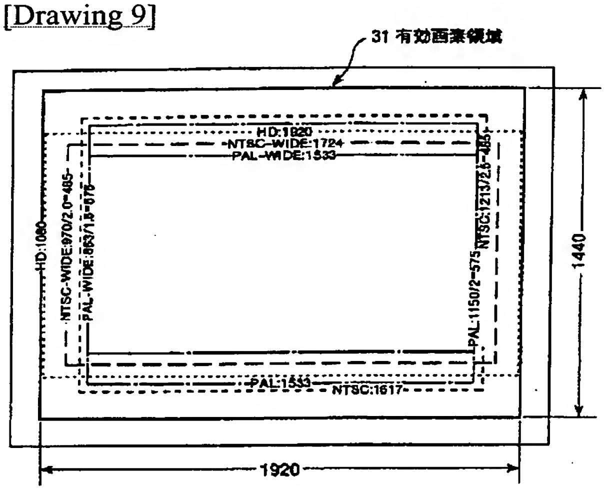
?+M、G+C、Y+G、M+C、Y+M、G+C、Y+G、M+C、Y+M、G+? ・・・a1
?+M、G+C、Y+G、M+C、Y+M、G+C、Y+G、M+C、Y+M、G+? ・・・a2
?+M、G+C、Y+G、M+C、Y+M、G+C、Y+G、M+C、Y+M、G+? ・・・a3

[Drawing 8]



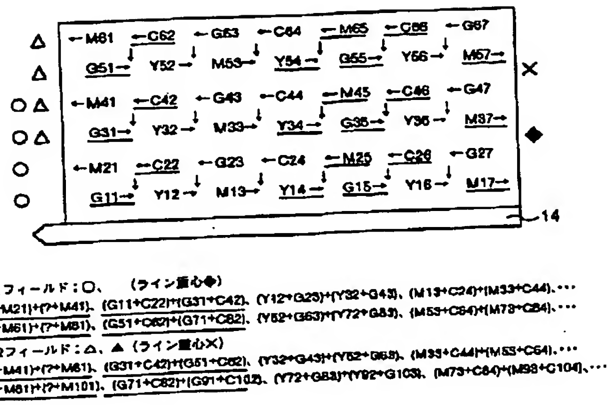
___、G+?、Y+?、M+?、Y+?、G+?、Y+?、M+?、Y+?、G+?
?+M、G+C、Y+G、M+C、Y+M、G+C、Y+G、M+C、Y+M、G+? ・・・b1
?+M、G+C、Y+G、M+C、Y+M、G+C、Y+G、M+C、Y+M、G+? ・・・b2
?+M、?+C、?+G、?+C、?+M、?+C、?+G、?+C、?+M、___

[Drawing 9]

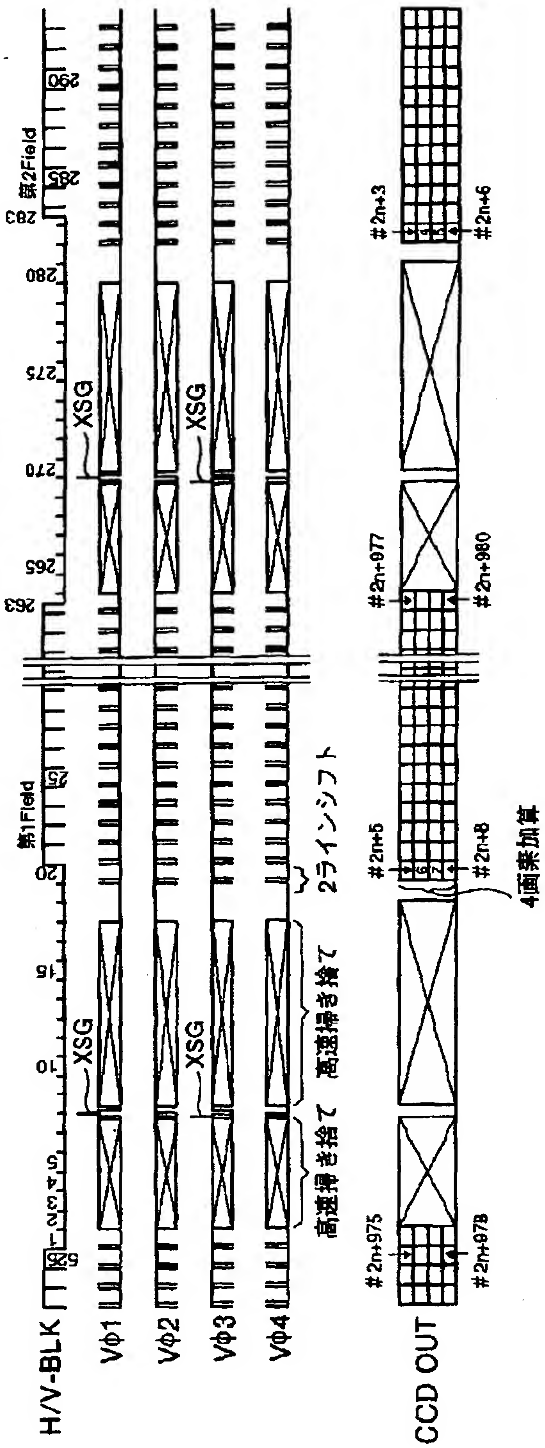


H1920＊V1440 非圧縮(278万画素相当)＝ 4：3 DSC、手振れ補正無し
H1940＊V1440 /3.0圧縮(93万画素相当)＝ 4：3 DSC-NTSC(480line)モニターリングモード
H1917＊V1440 /2.5圧縮(110万画素相当)＝ 4：3 DSC-PAL (576line)モニターリングモード
H1617＊V1213 /2.5圧縮(78万画素相当)＝ 4：3 NTSC、手振れ補正19%
H1533＊V1150 /2.0圧縮(88万画素相当)＝ 4：3 PAL、 手振れ補正25%
H1724＊V 970 /2.0圧縮(84万画素相当)＝16：9 NTSC、手振れ補正11%
H1533＊V 863 /1.5圧縮(88万画素相当)＝16：9 PAL、 手振れ補正25%

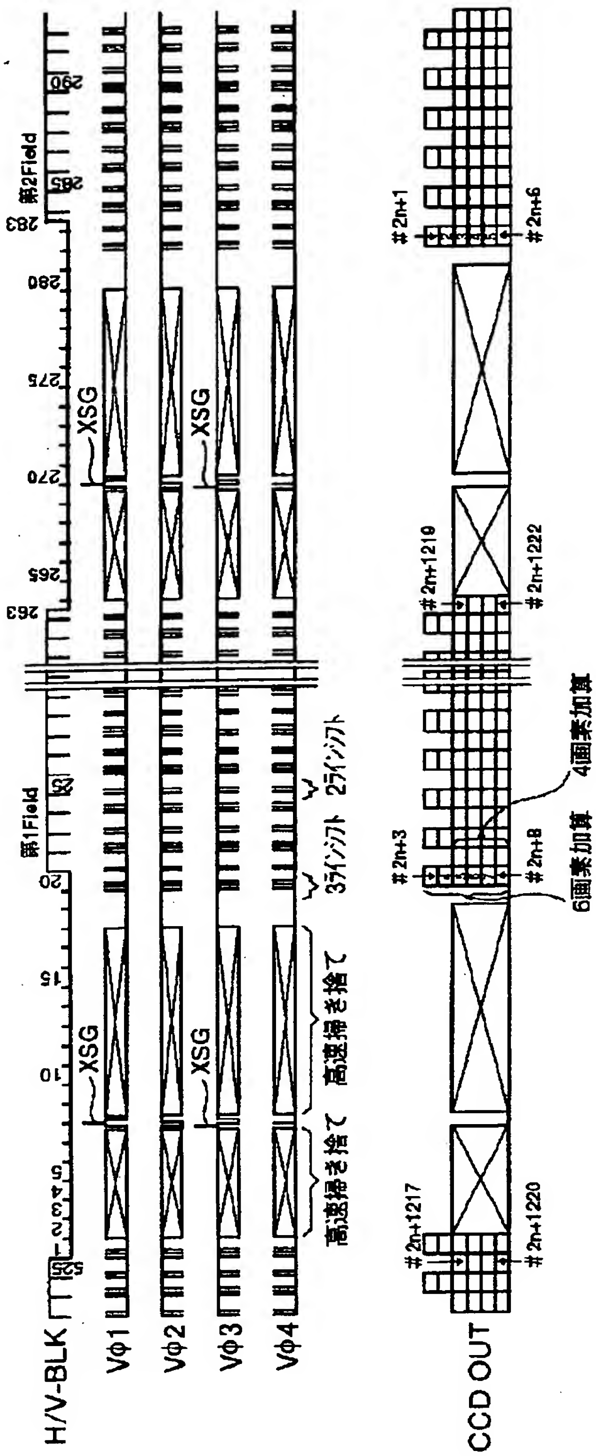
[Drawing 10]


←M81 ←C82 ←G83 ←C84 ←M85 ←C86 ←G87
G51→ Y52→ M53→ Y54→ G55→ Y56→ M57→
←M41 ←C42 ←G43 ←C44 ←M45 ←C46 ←G47
G31→ Y32→ M33→ Y34→ G35→ Y36→ M37→
←M21 ←C22 ←G23 ←C24 ←M25 ←C26 ←G27
G11→ Y12→ M13→ Y14→ G15→ Y16→ M17→
14
第1フィールド：○、 (ライン重心◆)
(?+M21)+(?+M41)、(G11+C22)+(G31+C42)、(Y12+G23)+(Y32+G43)、(M13+C24)+(M33+C44)、・・・
(?+M61)+(?+M81)、(G51+C62)+(G71+C82)、(Y52+G63)+(Y72+G83)、(M53+C64)+(M73+C84)、・・・
第2フィールド：△、▲ (ライン重心×)
(?+M41)+(?+M61)、(G31+C42)+(G51+C62)、(Y32+G43)+(Y52+G63)、(M33+C44)+(M53+C64)、・・・
(?+M81)+(?+M101)、(G71+C82)+(G91+C102)、(Y72+G83)+(Y92+G103)、(M73+C84)+(M93+C104)、・・・

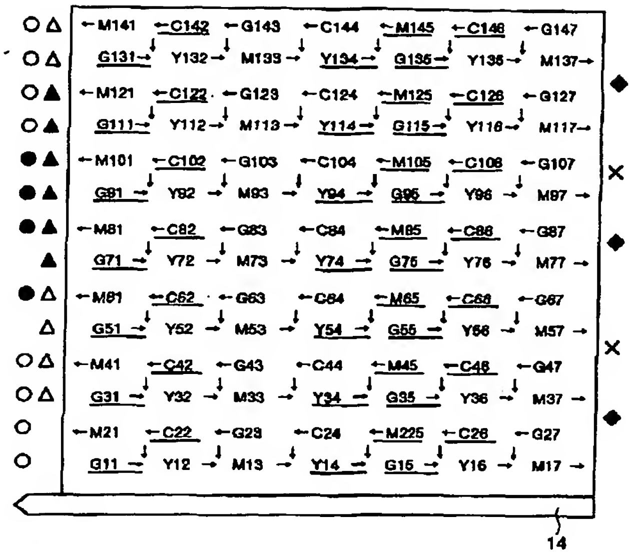
[Drawing 11]


H/V-BLK
Vφ1
Vφ2
Vφ3
Vφ4
CCD OUT
XSG
XSG
第1Field
第2Field
高速掃き捨て
高速掃き捨て
2ラインシフト
4画素加算
#2n+975
#2n+978
#2n+5
#2n+8
#2n+977
#2n+980
#2n+3
#2n+6

[Drawing 13]


H/V-BLK
Vφ1
Vφ2
Vφ3
Vφ4
CCD OUT
XSG
XSG
XSG
XSG
第1Field
第2Field
高速掃き捨て
高速掃き捨て
3ラインシフト
2ラインシフト
6画素加算
4画素加算
#2n+1217
#2n+1220
#2n+3
#2n+8
#2n+1219
#2n+1222
#2n+1
#2n+6
525
5
10
15
20
263
265
270
275
280
283
285
290

[Drawing 12]



第1フィールド：○、● (ライン重心◆)

(?+M21)+(?+M41)、(G11+C22)+(G31+C42)、(Y12+G23)+(Y32+G43)、…

(?+M61)+(?+M81)+(?+M101)、(G51+C62)+(G71+C82)+(G91+C102)、(Y52+G63)+(Y72+G83)+(Y92+G103)、…

(?+M121)+(?+M141)、(G111+C122)+(G131+C142)、(Y112+G123)+(Y132+G143)、…

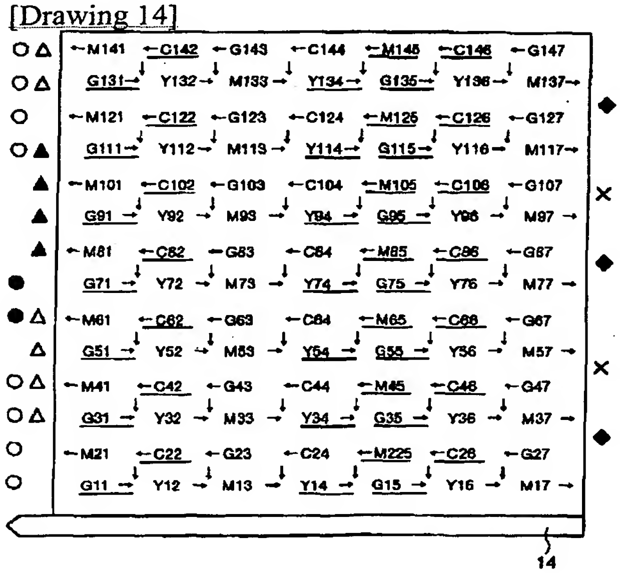
第2フィールド：△、▲ (ライン重心×)

(?+M41)+(?+M61)、(G31+C42)+(G51+C62)、(Y32+G43)+(Y52+G63)、…

(?+M81)+(?+M101)+(?+M121)、(G71+C82)+(G91+C102)+(G111+C122)、(Y72+G83)+(Y92+G103)+(Y112+G123)、…

(?+M141)+(?+M161)、(G131+C142)+(G151+C162)、(Y132+G143)+(Y152+G163)、…

[Drawing 14]



第1フィールド：○、● (ライン重心◆)

(?+M21)+(?+M41)、(G11+C22)+(G31+C42)、(Y12+G23)+(Y32+G43)、…

(?+M61)+(?+M81)+(?)、(C62)+(G71+C82)+(G91)、(G63)+(Y72+G83)+(Y92)、…

(?+M121)+(?+M141)、(G111+C122)+(G131+C142)、(Y112+G123)+(Y132+G143)、…

第2フィールド：△、▲ (ライン重心×)

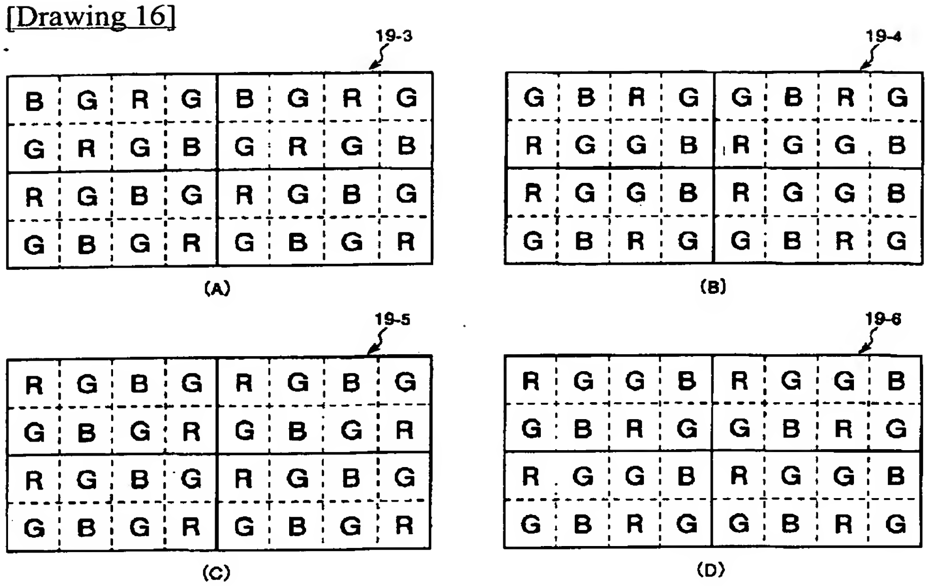
(?+M21)、(G11+C22)、(Y12+G23)、…

(?+M41)+(?+M61)、(G31+C42)+(G51+C62)、(Y32+G43)+(Y52+G63)、…

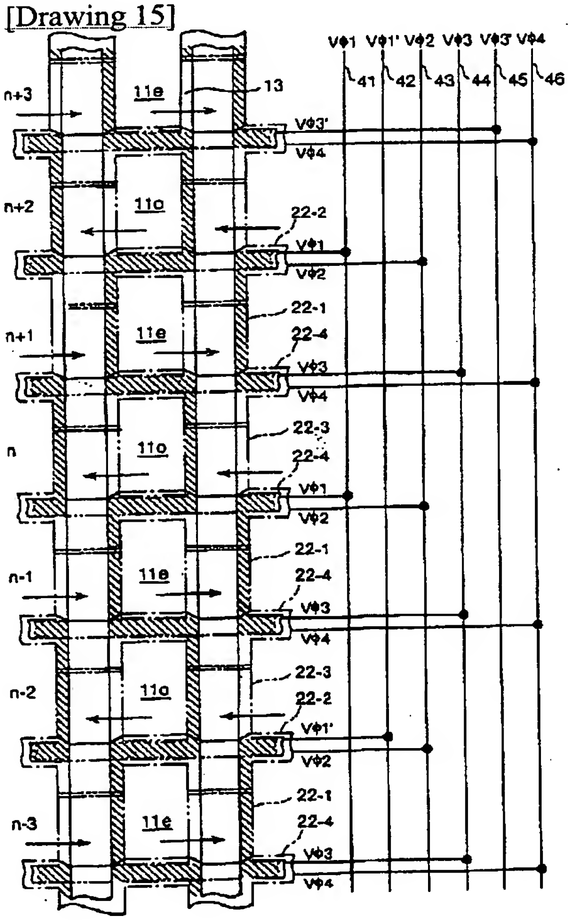
(M81)+(?+M10)+(?)、(C82)+(G91+C102)+(G111)、(G83)+(Y92+G103)+(Y112)、…

(?+M141)+(?+M161)、(G131+C142)+(G151+C162)、(Y132+G143)+(Y152+G168)、…

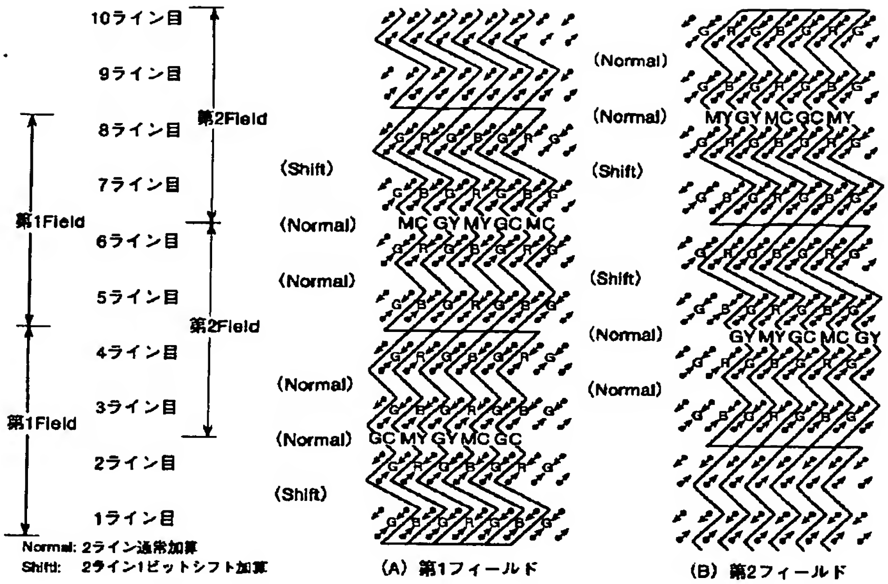
[Drawing 16]



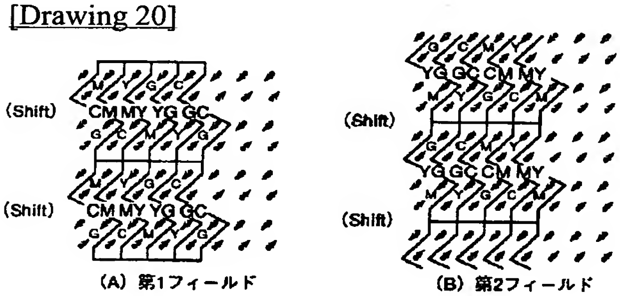
[Drawing 15]



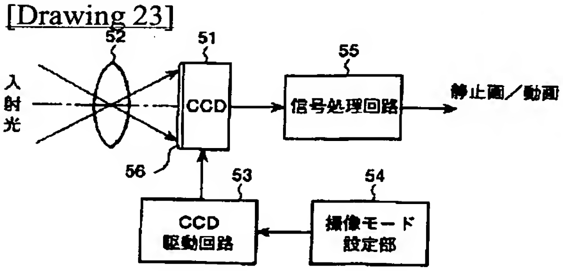
[Drawing 18]



[Drawing 20]

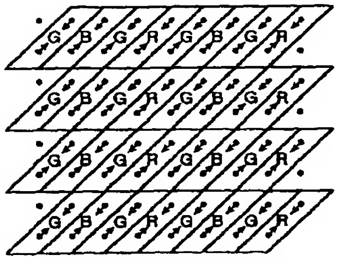


[Drawing 23]

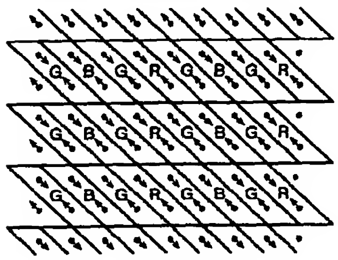


[Drawing 21]

(A) 第1フィールド

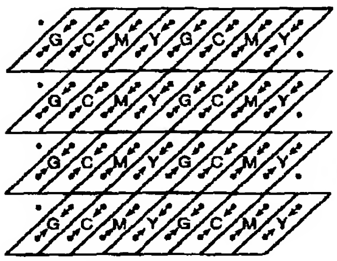


(B) 第2フィールド

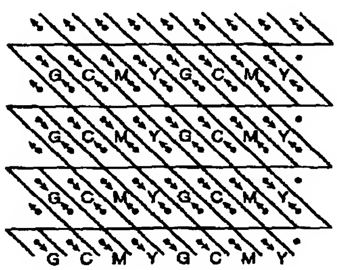


[Drawing 22]

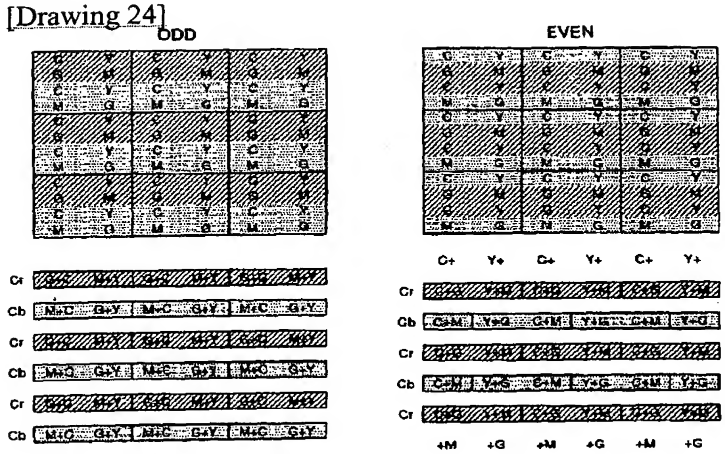
(A) 第1フィールド



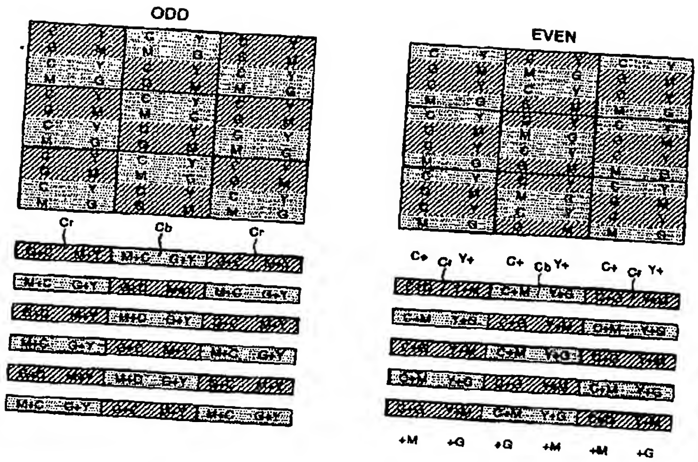
(B) 第2フィールド



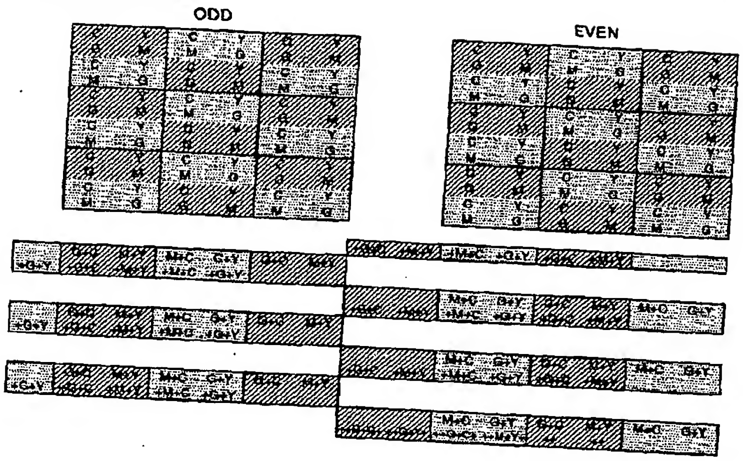
[Drawing 24]



[Drawing 25]



[Drawing 26]



[Translation done.]